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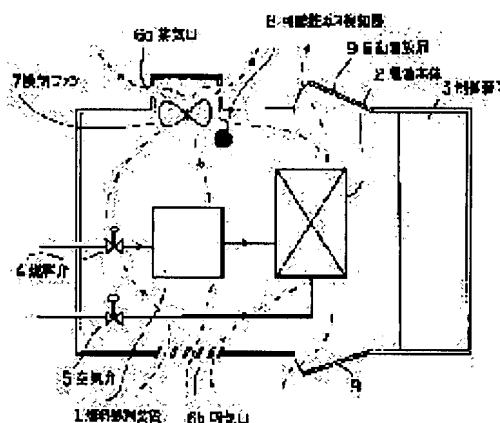
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(54) PACKAGE-TYPE FUEL CELL POWER GENERATION EQUIPMENT AND OPERATION CONTROL METHOD THEREFOR

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a package-type fuel cell power generation equipment and an operation control method therefor by which superior operation rate can be maintained, while securing safety and a burden is not imposed on a battery main body.

SOLUTION: A battery main body 2, a fuel-processing device 1, a fuel valve 4, an air valve 5, a control device 3 and piping and the like are housed in a package 6. An exhaust port 6a, an intake port 6b and a ventilating fan 7 are arranged in the package 6. An inflammable gas detector 8 is arranged in the vicinity of the exhaust port 6a and the ventilating fan 7 in the package 6. An automatic opening door 9 whose opening/closing operation is performed by a driving mechanism is arranged in the package 6. The inflammable gas detector 8 and a driving source of the driving mechanism of the automatic opening door 9 are connected to the control device 3. An opening/closing control part, for controlling the driving source of the driving mechanism on the basis of a detecting signal from the inflammable gas detector, is set in the control device 3.



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CLAIMS

[Claim(s)]

[Claim 1] The packaged type fuel cell generation-of-electrical-energy facility characterized by forming the inflammable gas detector in said package in the packaged type fuel cell generation-of-electrical-energy facility with which the body of a fuel cell and the gas distribution plant for cell reactions were held in the package, and the exhaust port and inlet for ventilation were established in said package.

[Claim 2] The packaged type fuel cell generation-of-electrical-energy facility according to claim 1 characterized by preparing the automatic disconnection door which can be opened and closed with a drive in said package, and forming the closing motion control device which controls actuation of said drive based on the detection signal from said inflammable gas detector.

[Claim 3] The packaged type fuel cell generation-of-electrical-energy facility characterized by holding the body of a fuel cell, and the inflammable-gas supply equipment for cell reactions in a package, forming an inflammable gas detector in said package in the packaged type fuel cell generation-of-electrical-energy facility with which the exhaust port, inlet, and ventilating fan for ventilation were prepared in said package, and forming the ventilating-fan control device which controls the engine speed of said ventilating fan based on the detection signal from said inflammable gas detector.

[Claim 4] A packaged type fuel cell generation-of-electrical-energy facility given in any 1 term of claims 1-3 characterized by forming two or more said inflammable gas detectors.

[Claim 5] The packaged type fuel cell generation-of-electrical-energy facility according to claim 4 characterized by forming said two or more inflammable gas detectors in the location where it differs in a package, respectively.

[Claim 6] The operation-control approach of the packaged type fuel cell generation-of-electrical-energy facility characterized by to reduce a generation-of-electrical-energy output when supply inflammable gas to the body of a fuel cell held in the package, perform a generating mode and leakage of inflammable gas is detected by said inflammable gas detector in the operation-control approach of the packaged type fuel cell generation-of-electrical-energy facility which ventilates with a ventilating fan through the exhaust port and the inlet established in said package, and detects leakage of the inflammable gas in said package with an inflammable gas detector.

[Claim 7] In case inflammable gas is supplied to the body of a fuel cell held in the package and a generating mode is performed It ventilates with a ventilating fan through the exhaust port and inlet which were established in said package. In the operation-control approach of the packaged type fuel cell generation-of-electrical-energy facility which detects leakage of the inflammable gas in said package with an inflammable gas detector The operation-control approach of the packaged type fuel cell generation-of-electrical-energy facility characterized by choosing and performing whether operation is suspended according to the leakage situation after dropping a cell output gradually when leakage of inflammable gas is detected by said inflammable gas detector, or shutdown is carried out immediately.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the packaged type fuel cell generation-of-electrical-energy facility with which the body of a fuel cell was held in the package with other device and piping, and relates to the packaged type fuel cell generation-of-electrical-energy facility which improved to the function to leakage of the inflammable gas from the device and piping in a package, and its operation-control approach.

[0002]

[Description of the Prior Art] Since a fuel cell is a power plant which transforms into direct electrical energy the chemical energy which fuels, such as a natural gas methanol, have and does not pass through the process of heat energy or kinetic energy, even if it is small-scale, it can expect high generating efficiency. And since it is easy to use the heat generated with a generation of electrical energy as hot-water supply or heating and cooling and it can raise total energy efficiency by it, it becomes possible to constitute the outstanding cogeneration system.

[0003] As this fuel cell, it is phosphoric acid fuel cells current and that development is progressing most. a phosphoric acid fuel cell -- many -- it has the cell stack which carried out the laminating of the unit cell called the cel of several sheets through the separator. Each cel pinches the matrix layer which sank in the phosphoric acid which is an electrolyte with the porous electrode substrate of a pair by which the catalyst bed was formed. And electrical energy is taken out from the above-mentioned inter-electrode one using the electrochemical reaction generated by supplying fuel gas, such as hydeogen-rich gas, to an electrode tooth back, and supplying oxidant gas, such as air, to the electrode tooth back of another side also in each cel.

[0004] The fuel cell generation-of-electrical-energy facility of comparison-small capacity installed in a location with the need of the electrical and electric equipment or heat among the generation-of-electrical-energy facilities using such a fuel cell is called an on-site fuel cell. As for an on-site fuel cell, it is common to be constituted as a packaged type fuel cell generation-of-electrical-energy facility with which the body of a fuel cell and other devices, piping, etc. were dedicated to the package so that conveniently [installing].

[0005] An example of this packaged type fuel cell generation-of-electrical-energy facility is explained according to drawing 2 . That is, the fuel processing unit 1 which makes original fuels, such as natural gas and a methanol, hydrogen is connected to the cell proper 2 equipped with the cell stack through piping. The fuel valve 4 is formed in piping for the fuel supply for supplying a original fuel to a fuel processing unit 1. The air valve 5 is formed in piping for the air supply for supplying air to a cell proper 2. These cells proper 2, the fuel processing unit 1, the fuel valve 4, and the air valve 5 have controllable composition with the control unit 3. And a cell proper 2, a fuel processing unit 1, a fuel valve 4, an air valve 5, a control device 3, and piping are held in the package 6.

[0006] Moreover, in a fuel cell, although inflammable gas, such as natural gas and hydrogen, is dealt with as mentioned above, if this inflammable gas is revealed from equipments and is piled up and

accumulated into a package 6, combustion and explosion temperature may be reached. Therefore, in a packaged type fuel cell generation-of-electrical-energy facility, it is necessary to pay attention to ventilation of the package 6 interior.

[0007] In the packaged type fuel cell generation-of-electrical-energy facility of the above configurations, in order to cope with this, as shown in drawing 2, exhaust-port 6a and inlet 6b are prepared in the upper part and the lower part of a package 6, respectively, and the ventilating fan 7 is installed in them by exhaust-port 6a. Since this configuration, then ventilating fan 7 enable it to incorporate the open air always fresh in a package 6, even if inflammable gas is revealed into a package 6 from equipments, it can prevent reaching the combustion and explosion temperature by stagnation and are recording of gas.

[0008]

[Problem(s) to be Solved by the Invention] by the way, the above on-site -- the design carried out automated-system-operation 1 is a base, and in the packaged type fuel cell generation-of-electrical-energy facility of business, in order to secure safety, at the time of a halt of a ventilating fan 7, the close by-pass bulb completely of the fuel valve 5 is carried out immediately, and it is designed so that a generation of electrical energy may be stopped. For this reason, when fixable, a leak rate can stop concentration low enough also by natural ventilation remarkably low, without stopping even if there is leakage and it is based on malfunction of a sensor, although continuation of a generation of electrical energy is possible, it can operate.

[0009] Moreover, since the existence of inflammable gas itself serves as a design which carries out the close by-pass bulb completely of the fuel valve 5 immediately, and stops a generation-of-electrical-energy facility in order to cause protected operation only by loss of ventilation functions, such as a halt of a ventilating fan 7, not understood, it causes hydrogen lack of a cell proper 2, and its burden is large.

[0010] Proposed in order that this invention may solve the trouble of the above conventional techniques, securing safety, the purpose can maintain the outstanding operating ratio and is to offer the packaged type fuel cell generation-of-electrical-energy facility by which a burden is not placed on a cell proper, and its operation-control approach.

[0011]

[Means for Solving the Problem] In order to attain the above-mentioned purpose, the body of a fuel cell and the inflammable-gas supply equipment for cell reactions are held in a package, and invention according to claim 1 to 5 has the following technical features in the packaged type fuel cell generation-of-electrical-energy facility with which the exhaust port and inlet for ventilation were established in said package.

[0012] That is, invention according to claim 1 is characterized by forming the inflammable gas detector in said package. In the above invention according to claim 1, since it is detectable with the inflammable-gas detection section 8 even if there is leakage of inflammable gas, safety by the early detection of an abnormal condition is attained.

[0013] Invention according to claim 2 is characterized by preparing the automatic disconnection door which can be opened and closed with a drive in said package, and forming the closing motion control unit which controls actuation of said drive based on the detection signal from said inflammable gas detector.

[0014] In the above invention according to claim 2, since ventilation airflow increases further by opening an automatic disconnection door in addition to ventilation by the exhaust port and the inlet when leakage of inflammable gas is detected by the inflammable-gas detection section, risk of necessarily not suspending operation but also depending ** on the rise of inflammable-gas concentration is avoidable.

[0015] Invention according to claim 3 is characterized by preparing the ventilating fan for ventilation in said package, forming an inflammable gas detector in said package, and forming the ventilating-fan control unit which controls the rotational frequency of said ventilating fan based on the detection signal from said inflammable gas detector.

[0016] In the above invention according to claim 3, when leakage of inflammable gas is detected by the inflammable gas detector, the rotational frequency of a ventilating fan is increased with a ventilating-fan

control unit. Then, since the ventilation airflow by the exhaust port and the inlet increases, risk of being based on the rise of inflammable-gas concentration is avoidable.

[0017] Invention according to claim 4 is characterized by forming two or more said inflammable gas detectors in a packaged type fuel cell generation-of-electrical-energy facility given in any 1 term of claims 1-3. In the above invention according to claim 4, more exact protected operation can be performed by comparing the measurement data of two or more gas detectors.

[0018] Invention according to claim 5 is characterized by forming said two or more inflammable gas detectors in the location where it differs in a package, respectively in a packaged type fuel cell generation-of-electrical-energy facility according to claim 4. In the above invention according to claim 5, since two or more inflammable gas detectors are formed in the location where it differs in a package, pinpointing of a leakage point becomes easy.

[0019] And in case claim 6 and invention according to claim 7 supply inflammable gas to the body of a fuel cell held in the package and perform a generating mode, they ventilate with a ventilating fan through the exhaust port and inlet which were established in said package, and have the following technical features in the operation-control approach of the packaged type fuel cell generation-of-electrical-energy facility which detects leakage of the inflammable gas in said package with an inflammable gas detector.

[0020] That is, invention according to claim 6 is characterized by reducing a generation-of-electrical-energy output, when leakage of inflammable gas is detected by said inflammable gas detector. In the above invention according to claim 6, since a generation-of-electrical-energy output (operating duty) declines when inflammable gas is detected, the amount of process gas decreases, a leak rate decreases, and risk of being based on the rise of inflammable-gas concentration can be avoided.

[0021] When leakage of inflammable gas is detected by said inflammable gas detector, after invention according to claim 7 drops a cell output gradually, it is characterized by choosing and performing whether operation is suspended or shutdown is carried out immediately according to the leakage situation.

[0022] In the above invention according to claim 7, since operation can be stopped [except] after dropping an output gradually when an emergency shut down is required, the performance degradation of a cell can be minimized.

[0023]

[Embodiment of the Invention] The gestalt of operation of this invention is explained below. In addition, the same member as the conventional technique shown in drawing 2 attaches the same sign, and omits explanation.

[0024] (1) Explain the gestalt of the operation corresponding to gestalt (configuration) claim 1 of the 1st operation, and invention according to claim 2 according to drawing 1. That is, it sets in the gestalt of this operation and the inflammable gas detector 8 is formed near exhaust-port 6a in a package 6, and the ventilating fan 7. And the automatic disconnection door 9 is formed in the package 6. This automatic disconnection door 9 has the composition that a switching action is performed, with the drive which is not illustrated.

[0025] Furthermore, the inflammable gas detector 8 and the driving source of the drive of the automatic disconnection door 9 are connected to the control unit 3. In the control unit 3, the closing motion control section which controls the driving source of a drive is set up based on the detection signal from an inflammable gas detector.

[0026] (Operation) In the gestalt of this operation which has the above configurations, when leakage of inflammable gas occurs within a package 6, this inflammable gas is led to the exhaust-port 6a side with a ventilating fan 7, and is detected by the inflammable-gas detection section 8. And based on this detection signal, the closing motion control section of a control unit 3 is operated so that the automatic disconnection door 9 may open the driving source of a drive. Then, since the open air flows when the automatic disconnection door 9 opens, the inflammable-gas concentration in a package 6 falls.

[0027] Moreover, since leakage of inflammable gas is detected by the inflammable-gas detection section 8 and the automatic disconnection door 9 is opened as mentioned above even if it is the case where a

ventilating fan 7 stops, the fall of the inflammable-gas concentration by ventilation is attained.

[0028] (Effectiveness) Since according to the gestalt of these above operations it is detectable with the inflammable-gas detection section 8 even if there is leakage of inflammable gas, safety by the early detection of an abnormal condition is attained. Since especially the inflammable-gas detection section 8 is formed near exhaust-port 6a and the ventilating fan 7 which the revealed inflammable gas surely passes, leakage is detected certainly.

[0029] Moreover, since the automatic disconnection door 9 opens, ventilation is made automatically and inflammable-gas concentration falls when leakage of inflammable gas is detected, high safety is securable. Since ventilation is securable even if a ventilating fan 7 stops especially, when a leak rate is below constant value, the design which does not carry out shutdown, then an operating ratio improve. Operation can be continued, when, and a leak rate is low and it will be based on malfunction of a sensor, without carrying out shutdown, even if a ventilating fan 7 stops if it is made such a design.

[0030] (2) Explain the gestalt of the operation corresponding to invention of gestalt (configuration) claim 3 publication of the 2nd operation. That is, it sets in the gestalt of this operation and the inflammable gas detector 8 is formed near exhaust-port 6a in a package 6, and the ventilating fan 7. And an inverter is connected to the motor of a ventilating fan 7 as a ventilating-fan control device, and the rotational frequency of a ventilating fan 7 has controllable composition with this inverter. Furthermore, the inflammable gas detector 8 and the inverter are connected to the control unit 3.

[0031] (The operation effectiveness) In the gestalt of this operation which has the above configurations, when leakage of inflammable gas occurs within a package 6, this inflammable gas is led to the exhaust-port 6a side with a ventilating fan 7, and is detected by the inflammable-gas detection section 8. And based on this detection signal, an inverter is controlled to raise the rotational frequency of the motor of a ventilating fan 7. Then, since the gas exchange by the ventilating fan 7 increases, the concentration of inflammable gas can be held down to below a lower explosive limit, and high safety can be secured.

[0032] (3) Explain the gestalt of the operation corresponding to gestalt claim 4 of the 3rd operation, and invention according to claim 5. That is, the gestalt of this operation forms two or more inflammable gas detectors 8 in the part where it differs in a package 6 in the gestalt of the above-mentioned 1st and the 2nd operation.

[0033] Since according to the gestalt of such this operation a leakage situation can be more correctly judged by comparing and calculating mutually the measurement data to two or more gas detectors formed in the package 6 in a control device 3 when there is leakage of inflammable gas, the dependability of the protected operation in the gestalt of the above-mentioned 1st and the 2nd operation improves, and it becomes that by which the employment as the whole generation-of-electrical-energy facility was stabilized.

[0034] Since especially the inflammable gas detector 6 is formed in the part where it differs in a package 6, presumption of the part which inflammable gas revealed becomes easy, and it can gather the effectiveness of detail investigation / repair restoration of the leakage point after a halt.

[0035] (4) Explain the gestalt of the operation corresponding to invention of gestalt claim 6 publication of the 4th operation. First, the configuration of the packaged type fuel cell generation-of-electrical-energy facility used for the gestalt of this operation is as follows. That is, the inflammable gas detector 8 is formed near exhaust-port 6a in a package 6, and the ventilating fan 7. And the inflammable gas detector 8 is connected to the control unit 3.

[0036] The gestalt of this operation performs the following operation controls in a packaged type fuel cell generation-of-electrical-energy facility of this configuration. That is, when leakage of inflammable gas occurs within a package 6, this inflammable gas is led to the exhaust-port 6a side with a ventilating fan 7, and is detected by the inflammable-gas detection section 9. And the operating duty (output) of a cell proper 2 is reduced by performing control which extracts a fuel valve 4 with a control unit 3 based on this detection signal. Then, in order that the amount of process gas may decrease, a leak rate decreases. Therefore, the concentration of inflammable gas can be held down to below a lower explosive limit, and high safety can be secured.

[0037] (5) Explain the gestalt of the operation corresponding to invention of gestalt claim 7 publication

of the 5th operation. In addition, although the packaged type fuel cell generation-of-electrical-energy facility used for the gestalt of this operation is the same as that of the gestalt of implementation of the above 3rd almost, the thing which not only the existence of gas leakage but the inflammable-gas detection section 9 can detect [of gas concentration] is used.

[0038] That is, when inflammable gas reveals the gestalt of this operation and it is detected by the inflammable-gas detection section 9, transition (trend) of inflammable-gas concentration is supervised in a control unit 3. And by the time it reaches lower explosion limit concentration, when there will be time allowances, after dropping an operating duty (output) gradually by extracting a fuel valve 4, you make it result in a coldness-and-warmth halt. Moreover, by the time it reaches lower explosion limit concentration, when there will be no time allowances, a generation-of-electrical-energy facility is suspended immediately.

[0039] As mentioned above, according to the gestalt of this operation, maintaining safety by giving selectivity to the shutdown approach according to a leakage situation, the damage to the cell engine performance by the unnecessary emergency shut down can be avoided, and the performance degradation of a cell can be minimized.

[0040] (6) The control unit 3 in the gestalt of operation of the gestalt above of other operations is also realizable by operating a computer by the software program which makes a procedure each element of the operation-control approach shown in the gestalt of the above-mentioned operation, although constituting by the control circuit of dedication is also possible. Moreover, the record medium which recorded such a software program can also be constituted.

[0041] Moreover, the suitable correspondence of the inflammable gas detector in the gestalt of the above-mentioned implementation according to a leakage situation is still attained by it not only detecting the existence of inflammable gas, but using what can measure concentration with an analog value or digital value. For example, in the gestalt of the 1st operation, when inflammable-gas concentration approaches a tolerance limit in a setup of a closing motion control section, it can set up so that an automatic disconnection door may be opened. And in the gestalt of the 2nd operation, the rotational frequency of a ventilating fan 7 can be controlled according to inflammable-gas concentration, and the amount of falls of an operating duty can be controlled in the gestalt of the 4th operation according to inflammable-gas concentration.

[0042] Furthermore, combination is freely possible for the gestalt of each above-mentioned operation. For example, if the gestalt of the 1st operation and the gestalt of the 2nd operation are combined, the ventilation control using closing motion of the automatic disconnection door 9 and the revolving speed control of a ventilating fan 7 will become possible. Moreover, if the gestalt of the 1st operation and the gestalt of the 4th operation are combined, it will become controllable [the inflammable-gas concentration using closing motion of the automatic disconnection door 9, and operating power control].

[0043]

[Effect of the Invention] As explained above, according to this invention, securing safety, the outstanding operating ratio can be maintained and the packaged type fuel cell generation-of-electrical-energy facility by which a burden is not placed on a cell proper, and its operation-control approach can be offered.

[Translation done.]